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ABSTRACT

The setting for this study was a basic education component of a summer youth program designed to increase chances of high risk adolescents, mostly minorities, whose ages ranged from 14-18, to experience more positive academic and employment outcomes. The instructional program used in both experimental and control classrooms emphasized mastery learning of a selected set of mathematics and reading/language arts objectives. Pretests and posttests based on the objectives were developed using the Academic Instructional Measurement System. Of the four sites used, only one was the experimental site where the mastery learning program was implemented using the microcomputer. Quantitative assessment of the experimental program was provided by comparing the effect sizes of the experimental group with the effect sizes of the remaining three sites. Observations were made of the instruction given in the experimental classroom as well as one of the other program sites. The results provide additional evidence of the effectiveness of mastery learning techniques with high risk and minority students. Students at each location made sizeable gains in both mathematics and reading/language arts during a fairly short time period. Although the quantitative results did not show the computer setting to be more effective than the non-computer setting, the qualitative analyses of these two settings revealed educational benefits for high risk students in the computer environment that may not be reflected in a measure of academic achievement. These students demonstrated an increased sense of social integration and bonding, factors that may help to reduce dropout. (16 references) (GL)

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# Using Microcomputers to Implement Mastery Learning with High-Risk and Minority Adolescents

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## Introduction

High risk adolescents are likely candidates for negative educational outcomes such as academic failure or early withdrawal from school. Hispanic students are particularly at risk, having one of the highest education attrition rates of any minority--one which increases as years of education increase (Cortese, 1985; de los Santos, Montemayor, & Solis, 1983). Only 60.3% of Hispanics who begin school reach the twelfth grade (Commission on Civil Rights, 1974).

The academic difficulties of minority and high risk adolescents have been attributed to several educational factors. Specifically, the teaching methods used to reach the majority of students in traditional educational settings are not effective for high risk students. In other words, traditional teaching methods are incongruent with the learning styles of high risk and minority students. Consequently, these students experience a history of difficulty and failure in traditional educational settings.

More globally, and not unrelated to the issues of student success and incongruence of learning style and instruction, social bonding theory has been used to explain the educational difficulties of high risk students. Using this theory, Rutter (1988) argues that high risk students feel alienated in traditional school environments. These students' values are not congruent with the values and beliefs of others in the culture and, as a result, intimate relations with significant others in the educational environment or community, such as teachers and peers, are weak or absent. "The youth who does not have the love and respect of those significant others will thus be free to reject the normative pattern they attempt to impose" (Wehlage, Stone, & Kliebard, 1980).

This more global explanation of the academic failure of high risk adolescents is consistent with theories that have been developed to explain drop out in higher education institutions and attempts to drop out of the society at large. For example, in his theory on college student retention, Tinto (1975) proposes that individuals in a higher education institution are more likely to drop out if they are insufficiently integrated into that system or maintain values that have insufficient congruence with the prevailing value patterns of the academic environment. Tinto contends that this incongruence affects both the social and academic relationships associated with the educational environment. Tinto's theory is based on an interpretation of Durkheim's (Spady, 1970) sociological explanation of suicide which basically states that suicide is more likely to occur when individuals are insufficiently integrated into society.

Mastery learning techniques (Bloom, 1981) have been implemented in programs designed to provide high risk and minority youth with more positive academic experiences. These techniques attempt to establish congruence between the learning styles of these students and the methods used in teaching them. Two major advantages of the use of mastery learning with high risk students are the provision of a defined body of content for the instructional encounter and the repeated exposure of

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the content until the student has achieved the immediate goal of instruction. These strategies are designed to encourage students
to experience academic success in small steps that lead to more significant academic accomplishments, and have been found to be effective for improving the academic success of high risk students (Ascher, 1987); Garton, 1984). One reason for the success may be that mastery learning assures proficiency in prerequisite knowledge or tasks before moving on to more difficult learning that requires this knowledge.

The computer is an excellent tool for implementing mastery learning techniques. It can provide repeated exposure to content, consistently presenting, scoring, and providing feedback to the students and instructor during instruction. These attributes address the specific issues of student success and congruency between instruction and student learning styles.

However, the using the computer to implement mastery learning can go beyond matching learning and teaching styles to helping to create an effective educational environment in which high risk adolescents do not feel alienated, but integrated. For instance, the use of computers can help to create environments that address both the academic and social integration of high risk students into educational cultures. Tinto (1975) defines academic integration as the intellectual development of the individual that occurs as a result of interaction within an educational environment, and social integration as the quality of interactions with peer and teachers within an educational environment.

Using computers in the classroom promotes student intellectual development because it improves the quality of student learning, especially for high risk students. Students find working with computers very appealing. Hess and colleagues (1970) reported that students perceive information available to the computer as vast and accurate, and they regard the computer as fairer, easier, and more likeable then teachers. Using computers gives students more control over their learning and, thus, places ownership and responsibility for learning with the student. The use of computers, especially in implementing mastery learning, frees the teacher to provide individual help to students. Also, because the computer becomes the disseminator of information and improves the students' lower level cognitive skills such as memory and comprehension, the instructor's efforts can be focused on teaching the students higher level thinking skills (Carney, 1986).

Computer environments can also be conducive to students building positive, high quality relationships with others in the educational setting. Because the computer can be sued to provide evaluative feedback to students, the teacher/student interaction can become less focused on evaluation and more focused on identifying how the teacher can assist the student. Additionally, the evaluation reported by the computer is recognized by the student as an objective appraisal devoid of opinions formed by previous success or failure (Hess, et al., 1970). By relieving the tension typically associated with evaluation by high risk students, the student/teacher relationship can become more democratic and more conducive to positive interactions in the computer environment.

Interaction between students becomes more productive in an educational culture which includes computers. The interaction becomes more task oriented; student tend to collaborate when working on the computer (Olson, 1988). In general, relationships in the educational environment using computers and mastery learning may become

more positive because high risk students have successful educational experiences which lead to positive feelings that are associated with these settings.

Much of the research done on the use of computers in education has compared computer use to using other more traditional forms of instruction in more or less "clean" and controlled conditions. These studies provide evidence that student learning is greater when the computer is used (Salomon, 1988; Salomon, Globerson, & Guterman, under review). However, this research approach severely underestimates the potential of using computers in actual classrooms. As discussed earlier the computer can have positive effects on variables in the educational environment, such as teacher role and student locus of control. Thus, these "clean" environments which control these "extraneous" variables may disguise some of the most appealing effects of the use of the computer in the classroom (Papert, 1987; Salomon, in press).

The setting for this study was a basic education component of a summer youth program designed to increase the chances of high risk adolescents, mostly minorities, to experience more positive academic and employment outcomes. The students participated in work activities as well as basic education activities and were pail for their participation in both components of the program. The basic education component provides remediation to participants in the areas of math and reading/language arts. The experimental program studied in this project involved microcomputers in addition to the other components of mastery learning existing in the control program. Qualitative methods were used in this study in addition to quantitative methods to gain a more holistic perspective of how mastery learning, computer environments influence the academic success of high risk and minority adolescents.

## Method

### Program Description

The instructional program used in both experimental and control classrooms emphasized mastery learning of a selected set of math and reading/language arts objectives. Prior to the program, clearly defined objectives were established for the students. Pretests and posttests were developed using the Academic Instructional Measurement System (currently published by the Psychological Corporation) based on these objectives. The teachers in the program developed bi-weekly tests on the objectives to monitor the progress of the students. Instruction was adjusted based on these tests to enable all students to reach the objectives successfully. In the experimental classroom, the mathematics program involved instruction, repeated practice, and intermittent testing via computer.

### Quantitative Methods

Quantitative assessment of the experimental program was provided by comparing the effect sizes of the experimental group with the effect sizes of the remaining three sites involved in the 1988 summer youth program. Effect size is calculated by subtracting the pretest mean from the posttest mean and dividing by the pretest standard deviation. The pretest standard deviation was used to divide the difference between the pretest and posttest scores because this resulted in a more conservative effect size. Because separate math and reading/language arts tests was administered to the students, separate analyses were conducted for these two content areas.

The experimental group (Site 1) consisted of 15 students, Site 2 of 22 students, Site 3 97 students, and Site 4 of 131 students. All students in the basic education program ranged in age from 14 to 18.

Qualitative Methods

Observations were made of the instruction given in the experimental classroom as well as one of the other 1988 summer program sites which did not use computers to implement the mastery learning techniques. Three observations of a full day of instruction were made of the experimental and control groups. The observations were made during the first, fourth, and seventh weeks of the seven week program at both locations during the summer of 1988. All observations were made by the same researcher.

A systematic approach recommended by Miles and Huberman (1984) was used in obtaining and analyzing the observations. Analysis of the data began during the observations and continued after the observations were completed. The data were examined for recurring patterns and themes, and relationships between variables. The themes, patterns and relationships noted during initial observations were verified in the remaining observations.

## Results

Quantitative Results

The results of the quantitative analyses for math and reading/language arts for the experimental (Site 1) and control sites (Site 2 through 4) are summarized in Table 1.

Table 1

Reading/Language Arts

| | | Pretest | | Posttest | | Effect Size |
|---|---|---|---|---|---|---|
| Site | N | Mean | SD | Mean | SD | of Gain |
| Site 1 | 15 | 27.9 | 9.1 | 42.6 | 6.7 | 1.62 |
| Site 2 | 22 | 30.0 | 8.9 | 45.0 | 7.4 | 1.58 |
| Site 3 | 97 | 26.7 | 8.3 | 42.8 | 7.4 | 1.94 |
| Site 4 | 131 | 25.2 | 10.8 | 38.9 | 10.4 | 1.27 |

Mathematics

| | | Pretest | | Posttest | | Effect Size |
|---|---|---|---|---|---|---|
| Site | N | Mean | SD | Mean | SD | of Gain |
| Site 1 | 15 | 21.4 | 5.3 | 29.5 | 4.5 | 1.53 |
| Site 2 | 22 | 21.5 | 5.6 | 31.0 | 4.6 | 1.70 |
| Site 3 | 97 | 20.9 | 4.9 | 28.2 | 4.7 | 1.49 |
| Site 4 | 131 | 20.3 | 5.5 | 27.3 | 5.6 | 1.27 |

An effect size of 1.5 indicates that the average posttest score surpasses about 93% of the pretest scores; this can be interpreted to mean that the average student after the basic educational component scores higher than around 93% of the students prior to the program. All students in the program had effect sizes close to 1.5 in both math and reading/language arts. The experimental group did not score appreciably higher or lower than nay control group.

Qualitative Results

Mastery Learning Techniques. The observations made in this study confirmed the use of mastery learning techniques in both the experimental and control locations. The same objectives were selected for both sites. Students were tested over the objectives often, and the students' performance on the tests were used to guide and inform subsequent instruction. Students who did not reach mastery when tested received additional instruction until mastery was achieved.

Description of the Experimental Setting. The instruction given to one of the two groups of students who participated in the basic education component of the summer program at the experimental site was observed throughout the seven week program. The experimental group consisted of nine students, whose ages ranged from 14 to 18. The group included three Hispanic males, two Hispanic females, three Anglo males, and one Anglo female.

The same instructor taught both math and reading/language arts to the observed group. The experimental group attended the basic education classes two days per week for seven hours per day in a high school classroom containing six computers.

A typical day for the students began with a brief lecture on language arts, followed by independent work on worksheets which were related to the lecture. The students would work on the reading/language arts assignments until lunch. After lunch the instructor would give a brief lecture on math and then assign independent work over the math lecture. Most of the math assignments were computer-assisted-instruction lessons. Students would either work independently, with other students, or with the instructor on all assignments.

The students who finished their daily assignments early would either work on assignments not finished the day before, assist other students who needed help, perform instructional duties such as grading papers or recording completion of assignments, or use the computers recreationally (play computer games, write songs using the word processor, etc.) individually or with other students. During the time they were working on their assignments, students were free to move around the room as needed, or leave the classroom for short breaks. While the students worked on their assignments the instructor mainly assisted the students who needed the most help understanding and completing the independent work.

Description of the Control Setting. The instruction received by participants of the basic education component of the summer program was observed at one of the program sites where computers were not used to implement mastery learning. The group at this location consisted of 19 students who ranged in age from 14 to 18. The control group included four Hispanic females, nine Hispanic males, one Anglo female, one Anglo male, one Asian male, and two black males.

These students received their math and reading/language arts instruction from two different teachers. They attended the basic education classes three days per week for five hours per day in two classrooms at a community college.

The structure of a typical day for the control students was somewhat different than for the students at the experimental location. The day began with a lecture by the math instructor. The math instructor would then work out problems with the students on the board. After the lecture, the students were given assignments relating to the math instruction to work on individually, usually in the form of worksheets. The students worked on the assignments alone or elicited help from the teacher. The students remained in the same seat during all instruction and independent work.

The students who finished their independent work before the others would either sit quietly in their seat or socialize with other students. The instructor spent his time assisting students who needed help and monitoring the socializing of students who were finished with their work or who were interacting before they finished their worksheets. The math instructor discouraged any form of student socialization during class time.

After slightly more than one hour of math instruction, the students would transfer to the reading/language arts class which was taught by another instructor. This class also began with a lecture on a particular aspect of reading/language arts, followed by an assignment of independent work.

The events that took place during the independent work of the students in their reading/language arts class was similar to the math class. The students remained seated while working independently and did not consult each other regarding the assignment; however, they sometimes attempted to socialize about other matters. When the students completed their independent work before other students in the class, they either sat at their desk quietly or socialized with other students. While the students worked independently, the reading/language arts teacher spent her time assisting students who needed help and discouraging student socialization..

After slightly over one hour of reading/language arts instruction, the students returned to their math classroom for about an hour, took a lunch break, and returned to their reading/language arts class for the remainder of the day. The additional instruction proceeded similarly to the initial instruction discussed above.

Observed Differences. Several factors in the educational environment differed in the experimental and control settings. For one thing, the instruction in the control setting was more similar to conventional school settings, while the instruction in the experimental setting was quite unconventional. The standard combination of lecture and seatwork was used in the control setting, and the instructors' lectures were frequently the focus of the classes. In the experimental classroom, however, the instructor's lectures required very little class time because much of the instruction took place on the computer. Therefore, the focus in the experimental setting was often on student activity.

Another factor that differed in the control and experimental environments was student responsibility. The students in the experimental classroom exhibited more responsibility for the operation of the class and thus, their own learning, than the students in the control setting. In the control setting, students depended on the

instructors for explicit instructions on how the class would proceed each day. These students became passive receivers of information.

In the experimental setting, the students were active participants in the educational environment. Once the short lectures were completed and the lessons were assigned, the students became responsible for their work and partly responsible for the management of the classroom. The students were responsible for deciding the order in which they worked on assignments, how to spend their time once their assignments were completed, when to ask for help, when to offer help, and when to take short breaks. The students in the experimental setting were also responsible for determining how to share six computers among nine people.

The role of the instructor differed in the control and experimental settings. In the control setting, the instructors spent most of their time lecturing, assisting students, and monitoring students socialization. In the experimental setting, the main activity of the instructor was to help students who needed the most assistance in learning the math and reading/language arts objectives. The students assumed many of the instructional duties, such as recording the successful completion of assignments for other students, grading assignments, and helping other students understand and complete their assignments. Additionally, because student interaction was permissible in the experimental setting and was almost always centered around learning, the instructor did not spend time monitoring student behavior.

Student interaction also differed in the control and experimental settings. Students were discouraged from interacting in the control environment, and the interaction that did occur was non-school related. Students in the experimental environment interacted often, and their interaction in the classroom often centered around their learning. For example, students taught each other the concepts they needed to complete the assignments, how to use the computer to complete the assignments, and how to use the computer recreationally. Students also helped each other with their worksheet assignments.

All of the factors discussed above worked together to create a different ecology in each setting. Two systems appeared to be operating within the ecology of the control classroom. The instructors had their own goals for the classroom, and the students had somewhat different goals. This dissimilarity occasionally caused conflict between the teachers and students which interfered with the learning process. On the other hand, the ecology of the experimental classroom appeared to be much more efficient. As the experimental program progressed, the students appeared to internalize the goals of the program. The students themselves began discouraging behavior in other students which disrupted learning. The common goal of the students in the experimental classroom was to learn rather than to avoid learning.

An observation made on the last instructional day of the experimental program illustrates the students' internalization of program goals. During mid-morning, the instructor announced that there would be a 15 minute break. The students checked their watches and left the classroom. The instructor also left the classroom and returned 20 minutes later to find all of the students at work. The students gently reprimanded the instructor for returning late. The students enforced the goals of their learning environment, even with the instructor.

The experimental setting also contributed to an efficient classroom ecology by creating a flexible learning environment. Although the ecology of the classroom involved coordination with others, the nitch a student found within this environment was not in relation to others, but was in relation to his/her own progress toward mastering the objectives. The individualized attention and opportunities for the students to choose what kind of learning activities to participate in, allowed the students to find the nitch within the ecology of the classroom most in line with their own ways of learning. The students in the control classroom were not offered the same amount of flexibility in determining their own learning process. The provision of the variety of resource materials in a variety of instructional modes is also an important assertion of the general philosophy behind mastery learning (Campbell, 1983).

## Discussion

The results of this study provide additional evidence of the effectiveness of using mastery learning techniques with high risk and minority students. The group of students at each location of the basic summer program made sizable gains in both math and reading/language arts during a fairly short period of time. Also, similar gains were accomplished in the program in previous years at the experimental (Site 1) and control sites (Site 2 through 8) (see Table 2).

Table 2

| 1986 | | | | 1987 | | | |
|---|---|---|---|---|---|---|---|
| Site | N | Math | Lang. Arts E.S. | Site | N | Math | Lang. Arts E.S. |
| Site 1 | 13 | 3.6 | 1.5 | Site 1 | 18 | 3.2 | 1.2 |
| Site 2 | 27 | 1.5 | 1.4 | Site 2 | 27 | 1.1 | 1.3 |
| Site 3 | 13 | 0.7 | 1.0 | Site 3 | 13 | 1.7 | 1.3 |
| Site 4 | 59 | 1.7 | 1.3 | Site 4 | 92 | 1.4 | 1.2 |
| Site 5 | 62 | 1.5 | 1.3 | Site 5 | 87 | 1.9 | 1.5 |
| Site 6 | 13 | 2.1 | 1.2 | | | | |
| Site 7 | 53 | 1.5 | 1.2 | | | | |
| Site 8 | 64 | 1.6 | 1.2 | | | | |

Note: sites 1 and 2 are the only sites that are consistent across Tables 1 and 2.

The use of mastery learning techniques in this program addressed some of the problems typically experienced by high risk students in traditional educational environments. Traditional environments require that students learn at a minimum pace of instruction in order to succeed. Often, high risk students do not keep up with the minimum pace. The mastery learning environment provided in the summer program required that instruction be adjusted and allocated according to the needs of the students to ensure the success of all students. In these settings, instruction was modified to be congruent wit the learning styles of the students. Additionally, the techniques used in the program afforded the high risk students with successful educational experiences that relieve the anxiety previously associated with educational settings, and build internal locus of control and academic

self-esteem.

The quantitative results did not suggest that using microcomputers to implement mastery learning was more or less effective than implementing mastery learning through more traditional methods in the program during this past year. During the two previous summers, the students at the computer site had demonstrated twice the gain of other sites (effect size of 3.2 and 3.6) in math, and had approximately equal performance in reading. No evidence was found to explain why the current year's results were different.

Although the quantitative results did not show the computer setting to be more effective than the setting without computers during the summer of 1988, the qualitative analyses of these two settings revealed educational benefits for high risk adolescents in the computer environment that may not be reflected in a measure of academic achievement, especially after only seven weeks of instruction. The qualitative analyses in this study revealed that the introduction of the computer into this educational setting not only provided these students with instruction congruent with their needs and successful educational experiences, but helped to create an environment that responded to these students' need for a sense of integration within an academic environment.

Several factors were identified in the mastery learning, computer setting which contributed to the development of an educational environment which fostered the academic and social integration of high risk students. In the computer setting, students learned to interact and cooperate with each other concerning their learning. They also learned to interact with their instructor as an ally rather than as an adversary. These positive interactions with others in the educational setting lead to a student's sense of social integration and bonding in that environment.

Several other factors recognized in the computer environment strengthened the academic integration of the students. Students in this setting learned to take responsibility for their own learning. This included playing a large role in determining the combination of activities to engage in to maximize their chances of reaching the learning objectives. Perhaps having a more substantial role, value, and stake in their learning outcomes helped these students to attribute their academic success in this program to their own efforts, thus, developing an internal locus of control.

Feeling integrated in an educational environment is an important experience for high risk students. These experiences may be a critical factor in the student's decision to complete his/her high school education. Additional analyses of interviews with students and teachers in the program who participated in mastery learning settings with and without computers will provide further comparative information on the longer term consequences of involvement in these different educational environments.

## References


Ascher, E. (1987). Chapter 1 programs: New guidelines from the research. Office of Educational Research and Improvement. Washington, D.C.

Campbell, M. (1983). Mastery learning in the college learning center. Paper presented at the National Association for Remedial/Developmental Studies Conference, Little Rock, AR.

Carney, C. C. (1986). Teacher + computer = more learning. The Computing Teacher, 13(2), 12-15.

Commission on the Higher Education of Minorities. (1982). Final report on the higher education of minorities. Los Angeles: Higher Education Research Institute, Inc.

Cortese, A. (1085). The denial of access: Chicanos in higher education. The Cornell Journal of Social Relations, 18(2), 28-39.

de los Santos, A. G. (1980). Hispanics and community colleges. Tucson: University of Arizona, Center for the Study of Higher Education.

Garton, S. (1984). Improving instruction for economically disadvantaged students. NASSP Bulletin, 68, 91-96.

Hess, R. D., Tenesakis, M., Smith, I. D., Brod, R. L., Spellman, J. B., Ingle, H.T. & Oppman, B. G. (1970). The computer as a socializing agent: Some socioaffective outcomes of CAI. Stanford Center for Research and Development in Teaching (Report No. 13).

Miles, M. B., & Huberman, A. M. (1984). Qualitative data analysis: A sourcebook of new methods. Beverly Hills, CA: Sage Publications.

Papert, S. (1987). Computer criticism vs. technocentric thinking. Educational Researcher, 16, 22-30.

Rutter, R. A. (1988). Effects of school as a community. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Salomon, G. (in press). Discontinuity between controlled study and implementation of computers in classrooms: A letter to a young friend. Technology in Learning.

Salomon, G. (1988). AI in reverse: computer tools that turn cognitive. Journal of Educational Computing Research, 4, 123-139.

Salomon, G., Globerson, T., & Guterman, E. (under review). The computer as a zone of proximal development: Internalizing reading-related metacognitions from a Reading Partner.

Tinto, P. (1975). Dropout from higher education: A theoretical synthesis of recent research. Review of Educational Research, 45(1), 89-125.

Wehlage, G. G., Stone, C. R., & Kliebard, H. (1980). Dropouts and schools: Case studies of the dilemmas educators face, Report to the Governors Employment and Training Office, Madison Wisconsin, University of Wisconsin.

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